

### Claim Amendments

1. (currently amended) An apparatus for scheduling the transmission of data packets for a plurality of data packet flows, said data packet flows being allocated given shares of the transmission capacity  $r$  of a communication link and being grouped in bundles, said bundles being allocated  
5 service shares of the processing capacity of said communication link, the transmission over the communication link being divided in service frames, a service frame offering at least one transmission opportunity to every data packet flow that is backlogged, a backlogged data packet flow being a data packet flow that has at least one data packet stored in respective one of a plurality of packet  
10 queues, the scheduling apparatus comprising:

means for determining the duration of the service frame; and

means for guaranteeing that each data packet flow always receives at least  
15 its allocated service share during a service frame if it remains continuously backlogged over ~~a sufficient number of consecutive service frames~~ the whole duration of said service frame, and that each bundle receives at least its allocated service share during a service frame if there is always at least one data packet flow in the bundle that remains continuously backlogged for the whole duration of  
20 ~~a said service frame over a sufficient number of consecutive service frames~~, said guaranteeing means including:

means for maintaining, for each bundle  $I$ , a cumulative share  $\Phi_I$  that relates to the sum of said service shares allocated to respective ones of said data  
25 packet flows that are grouped together in the same bundle  $I$ ;

means for computing, for each bundle  $I$ , a service ratio between the service share  $R_I$  allocated to said bundle  $I$  and said cumulative share  $\Phi_I$  of the bundle; and

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means for modulating said service shares allocated to respective ones of said plurality of data packet flows using the service ratio computed for respective ones of said plurality of bundles.

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2. (original) The scheduling apparatus of claim 1, wherein a Weighted Round Robin (WRR) algorithm is used to schedule the transmission of data packets.

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3. (original) The scheduling apparatus of claim 1, wherein a Deficit Round Robin (DRR) algorithm is used to schedule the transmission of data packets.

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4. (original) The scheduling apparatus of claim 1, wherein a Surplus Round Robin (SRR) algorithm is used to schedule the transmission of data packets.

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5. (original) The scheduling apparatus of claim 1, wherein the duration of said service frames is variable.

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6. (original) The scheduling apparatus of claim 1, wherein the duration of said service frames is fixed.

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7. (original) The scheduling apparatus of claim 1, wherein said means for determining the duration of a service frame include:

a global frame counter  $FRMCNT$ ;

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a start flag  $\sigma_I$  for each bundle  $I$  of said plurality of bundles; and

a frame flag  $FF_i$  for each data packet flow  $i$  of said plurality of data packet flows.

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8. (original) The scheduling apparatus of claim 7, wherein the start flag  $\sigma_I$  of bundle  $I$  is set equal to the global frame counter  $FRMCNT$  when the first data packet flow in the bundle becomes backlogged.

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9. (original) The scheduling apparatus of claim 7, wherein the frame flag  $FF_i$  of data packet flow  $i$  is set to a different value than the global frame counter  $FRMCNT$  when the flow becomes backlogged or is processed for the last time in the current service frame.

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10. (original) The scheduling apparatus of claim 7, wherein the end of a service frame and the start of the following one are simultaneously detected when the frame flag  $FF_i$  of the next data packet flow  $i$  to be processed has different value than the global frame counter  $FRMCNT$ .

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11. (original) The scheduling apparatus of claim 10, wherein the value of said global frame counter  $FRMCNT$  is set equal to the value of said frame flag  $FF_i$  after detecting a difference between the two values.

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12. (original) The scheduling apparatus of claim 1, wherein the value of the cumulative share  $\Phi_I$  of bundle  $I$  is equal to the sum of the service shares of the data packet flows of bundle  $I$  that are backlogged.

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13. (original) The scheduling apparatus of claim 12, wherein the value of the cumulative share  $\Phi_I$  of bundle  $I$  is set when a first data packet flow of the bundle is first serviced in a service frame, and kept unchanged for the whole duration of the same service frame, even if the backlog state of one or a plurality of data packet flows of bundle  $I$  changes during the service frame.

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14. (original) The scheduling apparatus of claim 13, wherein a running share  $\phi_I$  maintains the sum of the service shares of the data packet flows that are backlogged in bundle  $I$ , and changes when the backlog state of one or a plurality of data packet flows in the bundle changes, the value of said running share  $\phi_I$  being used to set the value of said cumulative share  $\Phi_I$  when required.

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15. (original) The scheduling apparatus of claim 13, wherein said first service to said first data packet flow of bundle  $I$  is detected when the start flag  $\sigma_I$  of the bundle  $I$  that includes the next flow  $i$  to be processed has different value than the global frame counter  $FRMCNT$ .

16. (currently amended) A method for scheduling the transmission of data packets for a plurality of data packet flows, said data packet flows being allocated given shares of the transmission capacity of an outgoing communication link and being grouped in a plurality of bundles, said bundles being allocated service shares of the transmission capacity  $r$  of said outgoing communication link, the transmission over the communication link being divided in service frames, a service frame offering at least one transmission opportunity to every data packet flow that is backlogged, a backlogged data packet flow being a data packet flow that has at least one data packet stored in respective one of a plurality of packet queues, the method comprising the steps of:

determining the duration of the service frame;

guaranteeing that each data packet flow always receives at least its  
15 allocated service share during a service frame if it remains continuously  
backlogged over ~~a sufficient number of consecutive service frames~~ the whole  
duration of said service frame, and that each bundle receives at least its allocated  
service share during a service frame if there is always at least one data packet  
flow in the bundle that remains continuously backlogged for the whole duration of  
20 ~~a said service frame over a sufficient number of consecutive service frames~~;

maintaining, for each bundle  $I$ , a cumulative share  $\Phi_I$  that relates to the  
sum of said service shares allocated to respective ones of said data packet flows  
that are grouped together in the same bundle  $I$ ;

25 computing, for each bundle  $I$ , a service ratio between the service share  $R_I$   
allocated to said bundle  $I$  and said cumulative share  $\Phi_I$  of the bundle; and

modulating said service shares allocated to respective ones of said  
30 plurality of data packet flows using the service ratio computed for respective ones  
of said plurality of bundles.

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